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ABSTRACT

These lectures consider the information concept as well as the epistemological foundations of information science. The first lecture discusses the epistemological roots of the information concept and the hermeneutical paradigm within modern epistemology. Particular attention is given to the roots of the information concept in everyday English. An example of the technical use of the term in medieval epistemology is provided and compared with the concept of "representation" in modern cognitive science. The second lecture discusses the paradigm of human understanding as developed by modern philosophical hermeneutics, and considers this paradigm in relation to information science in general, and information retrieval in particular. (54 references and notes). (Author/EW)

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Epistemology and Information Science

Rafael Capurro

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p. 10 line 19: possible instead of passive

p. 10 line 23: possible instead of passive

p. 10 line 26: abstracting the universal concept from the representational form or 'phantasm' instead of abstracting .... concept.

p. 10 line 27: sensible instead of conscious

p. 10 line 36: sensible instead of sensual

p. 21 line 26: from instead of form

p. 25 line 2: focal instead of vocal

p. 26 line 14: pragmatic instead of pragmatice

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ABSTRACT

Epistemology and information science

The lectures deal with the information concept as well as with epistemological foundations of information science. The first lecture is dedicated to the epistemological roots of the information concept and to a discussion of the hermeneutical paradigm within modern epistemology. With regard to the information concept I pay particular attention to its roots in everyday English and give an example of the technical use of the term in medieval epistemology (Thomas Aquinas). I compare the latter with the concept of "representation" in modern cognitive science. In the second part, I discuss the paradigm of human understanding as developed by modern philosophical hermeneutics.

Introductory Remarks

As information science has become increasingly aquainted with advanced problems of knowledge representation, processing and retrieval, some implicit epistemological questions and models within this field have been the subject of discussions particularly over the past few years. However, this dialogue between epistemology and information science which began fairly recently has a long tradition with regard to the concept of information. The term 'information' itself has a very rich epistemological background. It was used in classical Latin, for instance by Cicero, to denote the pictorial representation of objects in the human mind as well as the process of teaching, i.e. of forming the mind through knowledge communication /1/. The Latin term 'informatio' became a 'terminus technicus' in medieval epistemology and ontology and played an important role in the rationalist and empiricist theories of knowledge in modern philosophy. At present, the concept of information is very difficult to define as it is used in many different areas, not only in philosophy but also in the natural and social sciences /2/. This confusing situation can, on the other hand, be considered as a symptom of the potential theoretical relevance of this concept.

In this lecture, which bears the title 'Epistemology and Information Science', I will first pay special attention to the epistemological uses of the information concept, whose roots can be found in everyday language as well as in philosophic reflection. We learn to understand the meaning of words, as Wittgenstein reminds us /3/, when we know how they are used.

I will use as an example the medieval concept of 'informatio' in Aquinas' theory of knowledge which I shall compare with the modern concept of 'representation' in cognitive science.

In the second part I will discuss some arguments developed by hermeneutics which in its reflection on human understanding rejoins, on a more general level, the results attained by modern philosophy of science as to the structure of scientific thought. Against this background I finally give a possible view of information science, information retrieval and the meaning of the information concept within the framework of hermeneutics.

1. Epistemological roots of the information concept

a) English roots

In his famous dictionary dated 1755 Dr Johnson (1709 - 1784) /4/ mentions three uses of the word 'information', namely:

1) Intelligence given; instruction
2) Charge or accusation exhibited
3) The act of informing or actuation

The second meaning is a special application in the field of law of the first epistemological sense. The third use refers to ontology and this has not changed since ancient times. It has its roots as the epistemological sense too, in Greek philosophy. However, I shall not deal with the ontological use in this lecture.
According to Dr Johnson, 'information' means 'intelligence given', that is, it indicates the act of telling something to somebody, who (probably) ignores the content of the message. The use of this term in everyday English has in fact had this epistemological meaning since the end of the 14th century. The term 'instruction' is related to the process of education. Let us now look at one of Dr Johnson's quotations taken from Shakespeare's 'Coriolanus'. An imprisoned slave seems to know about a forthcoming invasion. Brutus does not trust him and suggests that he should be 'whipp'd' or beaten. Menenius answers Brutus in the following way:

> "(...) But reason with the fellow,
> Before you punish him, where he heard this,
> Lest you shall chance to whip your information,
> And beat the messenger who bids beware
> Of what is to be dreaded."
> (Coriolanus, Act IV, Scene VI)

As we can hear, 'information' is familiarly related to such concepts as 'to reason with somebody', to listen to what somebody has to say, to a messenger and to his message. Later there is a context of ignorance and expectation but also of common knowledge to which the information is supposed to be significant.

In a broader sense, we can say that 'information' is a concept which is situated in the field of human language and intersubjectivity. It refers to the process of telling something to somebody and to the content being transmitted. In short, it indicates a major human characteristic.
As you are well aware, this sense still prevails in today's English as well as in many other modern languages.
If we consult the Oxford English Dictionary /5/, we will again find a major distinction between the epistemological and the ontological meanings. With regard to the epistemological meaning the following differences are listed:

1. The action of informing, formation or moulding of the mind or character, training, instruction, teaching.
2. The act of informing; communication or the knowledge or 'news' of some fact or occurrence; the act of telling or the fact of being told of something.
3. Knowledge communicated concerning some particluar fact, subject, or event; that of which one is apprised or told; intelligence, news.
4. The act of informing against, charging, or accusing (a person).
5. Special in English Law.
6. In other legal systems.

The three last meanings are related to the special application in the legal field. Central senses are again the process of communicating something to somebody as well as the content of the message. When Shannon and Weaver developed their 'mathematical theory of communication', they explicitly referred to this epistemological meaning. They write: "As commonly used, information is a very elastic term, and it will first be necessary to set up for it a more specific meaning as applied to the present discussion". They intend to eliminate, as they say, the 'psychological factors' involved in this concept, in order to establish a "measure of information in terms of purely physical quantities." /6/.
This is of course a licit methodological procedure, but, as I shall remark later, it can lead to some confusion when the 'original' sense still pervades the derivative or analogical uses. Anyway, neither Shannon nor Weaver intended to forget the specific 'common' meaning of 'information', i.e. the semantic and pragmatic levels of the concept.

These levels were emphasised by Ch. W. Morris /7/, Y. Bar-Hillel /8/, D. M. MacKay /9/ and others, and they are, I think, essential to the use of the information concept within information science.

b) Information and Intellect in Aquinas

This is a very large and complex subject indeed. The Latin term 'informatio' as it was coined by Thomas Aquinas (1225 - 1274 A.C.) implies ontological, epistemological, pedagogical and linguistic senses. I shall refer to the epistemological use, pointing out its close connection to the concepts of 'intellect' ('intellectus') and 'perception' ('sensus'). Aquinas' theory of knowledge is deeply rooted in Greek and in particular in Aristotelian Psychology and Metaphysics. According to Aquinas man consists of an intimate union between matter, which is a potency, and the soul ('anima'), the active principle, which 'in-forms' matter. The result of this union or 'information' (in the ontological sense of the word) is a sensitive and intelligent being /10/.

Aquinas also applies this scheme to the analysis of human knowledge. He calls the knowing principle 'anima intellectiva', which also includes the sensitive principle or 'anima sensitiva'. To know an object means the capability of the 'passive intellect' to grasp the 'species' or form of the object. The Latin term 'species' translates Aristotle's term 'eidos', and it may mean the sensible individual form of things or a universal concept. Both senses are interrelated with regard to the process of knowledge. The sensible form informs the sensation and passive intellect ('informatio sensus', 'informatio intellectus possibilis'), being the agent intellect which produces the act of understanding by abstracting the representational form or 'phantasm' from the universal concept. Thus material and conscious things are understood to the extent that they are apprehended by sense, represented by imagination, and made intelligible by the intellect.

A characteristic of human knowledge is the combined movement of 'abstractio' and 'conversio'. Following Aristotle, Aquinas does not conceive, as Plato suggested, a direct knowledge of universal concepts, but instead a knowledge of material things through the process of universalization, Aquinas' technical term for this operation being 'conversio ad phantasmata'. In other words, human understanding is neither purely intellectual nor purely sensual, but a unity of both.

Scientific knowledge, which is of the necessary and universal, is considered by Aquinas as the application (by reflection) of universal objects (concepts, definitions, etc.), which are designed by names, to particular things.

Although modern philosophy criticized many aspects of this paradigm, the term 'information' continued to play a significant role, for example, in the English Empiricist tradition (J. Locke, G. Berkeley, D. Hume), in Th. Reid's 'Philosophy of Common Sense', and in W. Whewell's 'Philosophy of the Inductive Sciences' /11/. In all cases it still expresses the mediation between the mind and the objects as they are perceived by our senses. According to Whewell, 'ideas' are 'informed sensations' (not 'transformed') i.e. they are a product of the 'formative' power of the mind on sensations. As indicated by its original meaning in Latin, the term 'information' is very close in meaning to the concept of 'representation', which is a central concept of modern cognitive science. Let us now study it briefly before we compare the whole epistemological theory with the theory of understanding as developed by modern hermeneutics.

c) Information and Representation

In a recent, comprehensive and interdisciplinary study on the concept of information, Fritz Machlup remarks that the concept of 'representation' is one of the keywords of modern cognitive science, however, he adds:

> "it is not always clear just what is being represented and what is representing. One could imagine our knowledge representing something observed or assumed in the external world or our knowledge being represented by something going on or retained in our brain or nervous system; or our knowledge being represented by some expressions (visual, auditory and tactile), artifacts (signs, signals, symbols and codes), or various kinds of action (meaningful and communicable to others). Assuming that the stingy economizers of prepositions mean not representation by knowledge but representation of knowledge, we rule out the first of the three possible meanings; considering that most users much of the time do their research using computers, we rule out the second meaning. Thus, we conclude that the representations in question are largely in terms of computer programs." /12/

Representation by knowledge, in the first two senses mentioned by Machlup, i.e. representation by knowledge of something observed, or representation of knowledge in our minds, begins to signify something very similar to the meaning of ther term 'informatio' as it was used in medieval epistemology as well as in the Empiricist tradition, whereas representation of knowledge refers to the knowledge contents and to the possible ways they are objectivized. The difference between the traditional epistemological meaning of 'informatio' and 'information' and the modern use of 'representation' is commented upon in a letter from George A. Miller to Machlup, in which he recalls the importance of this concept in the Rationalist epistemological tradition since Descartes. He writes:

> " The cognitive sciences are those scientific disciplines sharing an interest in the representation and transformation of knowledge (read 'information' in the present context) (...) You are certainly right ... that 'representation' is a keyword in cognitive science. Historically, philosophers since Descartes have assumed that the mind somehow copies, reflects, or represents the real world, so representation is hardly a new idea. The philosophers, however, immediately raised the question of how we can possibly know whether or not the mental representation of the real world is correct, true, valid. At this point Hume, then Kant, then dozens of others were able to create professional philosophy out of the epistemological (metaphysical) problems that resulted. When cognitive scientists revert to the problem of representation, therefore, one assumes (or at least hopes) they have a better strategy in mind than the philosophers did, that there are other more important questions to ask about representations other than their accuracy, since that question is known to lead straight out of empirical science." /13/.

As a psychologist, Miller sees the potential relevance the study of representational process machines can have in enabling us to learn more about mental representations. This relevance is, as Margaret A. Boden remarks /14/, debatable when we take the differences between our embodiment and a machine, between human behaviour and computer programmes or between the social dimension of human perception and action into consideration. The modern concept of representation involves I think three different kinds of problem:

1. The type of knowledge which should be represented,
2. how it should be represented and
3. for whom it should be represented.

Cognitive science, as Machlup remarks, seems to be concentrated upon the first two questions. However, in my opinion the third question points to a basic problem, as it indicates that knowledge representations are not to be considered as such because of the fact that knowledge is represented, but because these representations are related to an interpreter. This raises the question of human understanding as an interpretation process, and in particular as interpretation of represented knowledge. Such a question is a key issue of the hermeneutical approach.

Margaret Boden points explicitly to hermeneutic and intentionalist theories as a conceptual basis for the discussion on the analogy between human subjectivity and computational performances /15/. In the next two parts of this lecture I intend to discuss some of the relationships between hermeneutics and information science.

2. The hermeneutical paradigm of human understanding

a) Preliminary remarks

Hermeneutics as a philological discipline dealing with the problems of text interpretation has a very long tradition indeed which I shall not evoke at this point /16/. I shall concentrate on the paradigm developed by philosophical hermeneutics which is an attempt to illuminate the complex issue of human understanding including the questions of text, or better, knowledge interpretation. The hermeneutical paradigm was developed by Hans-Georg Gadamer /17/, who continued the debate opened by Husserl's phenomenology and Heidegger's existential analytics. This paradigm has been subject to criticism by different philosophical currents. Some of them have lead to a mutual fructification and in some cases to striking similarities in the results. This has been possible because in many cases the spirit of polemics has been substituted by the spirit of dialogue and argumentation.

Before considering some main features of the hermeneutical paradigm, I would like to draw your attention to three main criticisms which should be kept in mind when talking about hermeneutics:

1. Critical rationalists /18/ criticized the attempts to consider hermeneutics as a special methodology for the humanities or 'Geisteswissenschaften' in contraposition to the methodology of the natural sciences based on causal explanations. This discussion was based partly on a mutual misunderstanding, but it lead to some interesting insights to which I shall refer later. In connection with this criticism, hermeneutics was accused of dogmatism as it seemed to be searching for some kind of definite ground or evidence. In my opinion, hermeneutical analyses are eo ipso conjec-tural and in no case is there (or should there be) a claim for 'absolute knowledge' or definite solutions.
2. Analytic philosophers criticized the tendency of hermeneutics in considering the meaning of words as something 'objective' at least in the sense of an intentional object of the mind. But meanings are dependent on their use or on the context in which they are used. This contextual argument, as I call it, is to be fully recognized. /19/. I think it has been taken into account within the theory of pre-understanding which I shall explain later.
3. According to the 'critical theory' ('kritische Theorie') /20/, Hermeneutics lacks reflection on problems concerning psychoanalysis as well as political ideologies.

   With regard to the first point, I should like to mention the work of the french psychoanalyst Jacques Lacan who is partly inspired by Gadamer's hermeneutics. The second point leads to ethical questions which have been developed by K.O. Apep for example /21/. In the following I shall present the hermeneutical paradigm as based on two argumentative discourses, the existential and the contextual-critical. These arguments are enriched by the above-mentioned criticisms.

b) The existential argument:

This was originally developed by Husserl's phenomenology and Heidegger's existential analytic. Its point of departure can be expressed in the following manner: whereas traditional epistemology, as we have already seen above, regarded the question concerning human knowledge to be a problem of the relationship between a knower and an object which, separated from each other, come to a partial 'fusion' (Kant called it

synthesis) in the intellectual act of knowing, phenomenology criticizes this point of departure and states the intentionality of knower and known object which thus build originally a whole. The whole, as Heidegger stressed, should not be considered idealistically, as the representative field of subjective conscience, but as the world (or 'world-openness') which is being shared by the human community. This shared world can be called the field of human existence (or 'Dasein'). This argument, as you can observe, criticizes the underlying assumption of dogmatic scepticism about the question of existence of an 'outside reality' which is posed by an isolated and capsule-like subjectivity. Dogmatic scepticism takes this paradigm for granted. According to the existential argument, we already share the 'world-openness' in community with others. 'Already' means, that the presupposition of a worldless subjectivity is being made on the ground of the existential experience of the 'Lebenswelt', as Husserl called it. Man's 'being-in-the-world' is furthermore not of the kind of a passive or mere theoretical expectator, but he is acting with others and constituting a common world through language /22/.

Hannah Arendt calls the existential dimension in all its variety and complexity, 'the 'web' of human relationships'. In her remarkable work, 'The Human Condition', she writes:

> "Action and speech go on between men, as they are directed toward them, and they retain their agent-revealing capacity even if their content is exclusively 'objective', concerned with the matters of the world of things in which men move, which physically lies between them and out of which arise their specfic, objective, worldly interests. These interests constitute, in the word's most literal significance, something which **interest**, which lies between people and therefore can relate and bind them together. Most action and speech is concerned with this in-between, which varies with each group of people, so that most words and deeds are **about** some worldly objective reality in addition to being a disclosure of the acting and speaking agent. Since this disclosure of the subject is an integral part of all, even the most 'objective' intercourse, the physical, worldy in-between along with its interests is overlaid and, as it were, overgrown with an altogether different in-between which consists of deeds and words and owes its origin exclusively to men's acting and speaking directly **to** one another.

> This second, subjective in-between is not tangible, since there are no tangible objects into which it could solidify; the process of acting and speaking can leave behind no such results and end products. But for all its intangibility, this in-between is no less real than the world of things we visibly have in common. We call this reality the 'web' of human relationships, indicating by the metaphor its somewhat intangible quality." /23/

In other words, an objectivist epistemology separates the 'objective' from the 'subjective web' or 'in-between' considering the last one as a less real superstructure, whereas a subjectivist epistemology does the contrary. The existential argument stresses the original unity of human intercourse with objective reality as well as with each other, which permits us to live in a pluralistic world, sharing the views 'between' us. The process of theoretical knowledge is not to be considered as something separated from the 'vita activa', which, according to Hannah Arendt, implies labour, work and action. On the contrary, thinking is said to be "the highest and perhaps purest activity of which men are capable." /24/. Human understanding as shown by the existential argument, is not an isolated human capacity, but a central complex phenomenon implying 'world-openness', inter-subjectivity, language and human action. This puts some traditional epistemological paradigms on their feet.

c) The contextual-critical argument:

This argument refers in particular to the linguistic dimension of human understanding. Traditional epistemology, as we have seen, considers the process of knowledge and the process of expressing knowledge through language as two separate events. According to hermeneutics our being with others sharing a common world is the place of articulation of language. This common world disclosure builds the pre-understanding on which thematic interpretation is based. Thus hermeneutics questions the epistemological 'tabula rasa'-theory, according to which the 'mind' would be a kind of pure observer reproducing an outside 'objective' reality. Modern philosophy of science, for example Popper's conception of knowledge as intrinsically 'theory-laden', has also achieved similar results.

In fact, Popper criticizes the attempt to make a separate methodology out of hermeneutics for the 'humanities', conceiving it in a subjectivist way. In my view, these criticisms of subjectivistic hermeneutics are very similar to the arguments developed by modern philosophic hermeneutics. The process of testing theories through experience can thus be considered as a special application to the field of scientific methodology of the dynamic relationship between situation, comprehension and interpretation, which has been metaphorically called the 'hermeneutic circle'. In the same sense, the open process of 'conjectures and refutations' can be seen as a special delimitation of the dialectic of questions and answers. Human knowledge is also of intrinsically conjectural character for hermeneutics. Within this view, statements are considered as possible answers to questions, and questions are always based on assumptions. Questions and answers form, hermeneutically seen, a critical and 'dialectical' process. It was H. G. Gadamer, who in his seminal work 'Truth and Method' /25/ conceived the role of 'prejudice' ('Vorurteil') as something pertaining to human understanding. In other words, human knowledge is always biased, pre-comprehension can never be completely eliminated. The ambitious programme of the Enlightment under the motto 'sapere aude' can be understood as a request that we should be aware of the limitations or, as hermeneutics says, 'horizons' within which we determine the possible sense of what appears to us. Popper speaks of the 'horizon of expectations' and Th. S. Kuhn /26/ has made clear the significance of 'paradigms' in the sense of a shared body of concrete expectations, which guides the work of 'normal science', and which can be criticized and radically changed in periods of 'revolutionary science'.
In a more general way, hermeneutics states that not only science but human life itself is constantly dependent on pre-understanding or, as Gadamer says, on 'prejudices'. He writes:

> "Prejudices are not necessarily unjustified and erroneous, so that they inevitably distort the truth. In fact, the historicity of our existence entails that prejudices, in the literal sense of the word, constitute the initial directedness of our whole ability to experience. Prejudices are biases of our openness to the world. They are simply conditions whereby we experience something - whereby what we encounter says something to us." /27/.

In other words, the 'tabula-rasa'-theory of knowledge is nothing but a myth and conversely, we are not prisoner to our prejudices, but can instead use them in a productive way in the event of understanding. Objectivity is a work of our biased intersubjectivity. It rests on presuppositions and is always open to revision in the light of further insight.

G. Fløistad, a Norwegian philosoper, has recently remarked on the parallel between the results achieved by hermeneutics and philosophy of science. He writes:

> "From the point of view of hermeneutic and structuralist theories of language, the meaning of a perceptual judgement is determined not merely by its theoretical superstructure, but by the wider context of ordinary language. The perceptual judgement and the theory of which it is a part, as well as scientific notions, statements and theories in general, are thoroughly embedded in ordinary language and ordinary ways of life. The significance of such overall claims are certainly difficult to assess. Hermeneutics and structuralism are on this point strongly influenced by the phenomenology of Husserl and Heidegger. According to phenomenology, our access to 'world' or 'reality' is conditioned by its constitution in our consciousness or understanding. And ordinary language or daily 'forms of life' play an important role in that reality-constitution. This is in principle no different from saying that observation-statements are interpretations whose meaning is theory-dependent. Hermeneutics and structuralism merely extend this principle into all realms of human life or consciousness. That is to say, the language-dependent view of reality in scientific understanding and explanation is but an application of a general principle to be found in all uses of languages. It appears to be a sort of Kantian property of our consciousness or understanding. And the application of this principle in science certainly derives its overall meaning from this general principle, common to both ordinary and constructed uses of languages." /28/

Gadamer calls this evolutionary interaction between pre-understandings: 'fusion of horizons' ('Horizontverschmelzung'). The process of understanding is essentially an open one and is therefore also a critical one, since its results are context-dependent and can always be criticized from other viewpoints.

It is interesting to remember that the idea of the fragility and relativity of human knowledge was considered to be a weakness of the so-called 'soft sciences' for a long time, whereas the 'exact sciences' were praised by the certainty of their results. Neither hermeneutics nor philosophy of science are, by any means, aiming at diminishing the strength of scientific methodologies. We are coming of age, that is all.

With the conception of human understanding as a world-open not vitious but creative 'circular' and intersubjective self-conditioned language-game, I believe hermeneutics is pointing to something as fascinating as ... Gödel, Escher, Bach, and Douglas Hofstadter /29/.

3. Hermeneutics and Information Science

a) Recent studies

Several authors, information scientists as well as philosophers, have drawn our attention to the relationship between hermeneutics and information science. Seeing as I have the honour of being able to hold this lecture in Stockholm, I should like to first mention the work of Börje Langefors. The following quotation may give some hints on his 'infological' approach:

> "If data are what is handled by computers and information is what is to be served to people, then information is totally distinct in kind from data. Information is of the same kind as knowledge and data must form sentences in some language. Data inform if they bring about changes in the knowledge of their users. This will only happen if the data (or sentences) are formed in correspondance with the knowledge structure (S) of the user. Data, or sentences, do not 'contain' information, they only 'represent' information fragments and the information becomes established only if these fragments are brought into connection with a knowledge 'whole'. This was brought out in terms of the 'infological equation' (Langefors 1966).
>
> $$I = i(D,S,t)$$
>
> where I is the information (or knowledge change) established by the transfer of some data (or signs) D. The equation is meant to stress that to obtain information (I) from certain data (D), an information process (i) is needed and the process requires a certain time (t). Furthermore the outcome of the process (I) is wholly dependent on the 'pre-knowledge' structure S available to the process (thus to the data user). To 'understand' the data or receive the information will mean to conceive of a situation or event observed by somebody else and recorded as D. A deeper understanding may then result by the process (user) drawing all sorts of conclusions from the information received. All this, clearly, will depend on (other parts of) S. It is immediately obvious that the knowledge structure S implies all the kinds of problems recently articulated under buzz words such as paradigms, world-view, language games, ideology, personal styles and hermeneutics. It should also be clear that the data D are, basically, any real-life pattern that may be not only perceived but also 'understood' or interpreted in some way." /30/.

In my opinion Langefors has successfully integrated the concept of pre-understanding in a theory of information science. However, the question still remains as to how far he still conceives human existence under the premise of a capsule-like subjectivity.

Nevertheless, intersubjectivity and the idea of a community of interpreters plays a central role in this 'infology'.

A. Diemer and N. Henrichs, founders of the philosophy documentation centre at Düsseldorf University, have also made important contributions to 'information science hermeneutics'. With reference to Husserl's phenomenology, Diemer calls the meaning of thought content being transmitted in the information process 'informem' /31/. 'Informemes' are constituted by the intersubjective process of understanding, and designated, for instance through the indexing and abstracting process, or in the processes of retrieval and evaluation. The core of Diemer's 'information science hermeneutics' can be seen in the phenomenological relationship between the 'informemes' and the interpretation community (ies).

'Informemes' are constituted only through the mediation of the interpreter's pre-understanding, which is itself a part of, for instance, the pre-understanding of a specialized scientific community. The computer processes only 'data' or, in the case of texts, 'tokens'. Diemer's approach has the merit of having been, as far as I know, the first attempt to consider the whole information field from the point of view of hermeneutics. Some of his ideas have been further developed by Henrichs.

Henrich's approach /32/ is based on hermeneutics as well as on Ch. S. Peirce's semiotics. Object, sign and interpreter, Peirce's central categories, constitute, according to Henrichs, the underlying structure of the information field. If we consider the information concept form this semiotic perspective, we can distinguish between the meaning or content of the messages, the signs used to represent it, and the interpreters, (producers, mediators, and recipients.) A characteristic of Peirce's semiotics and consequently of Henrich's approach is the non-separability of its three constitutive elements: it would be absurd to speak, for instance, of meaning 'in itself', without any relation to an interpreter as well as to the signs denotating it.

The production of meaning and the processing of linguistic signs becomes informational when we regard them against the horizon of a community of interpreters. Information is a social category. Characteristic of this approach is the close relationship between hermeneutic and semiotic categories. These ideas found a concrete application in the philosopher's documentation centre at Düsseldorf University. The system, which cannot be analyzed here, is based on a non-standardized indexing method without taking the disadvantages of free-text into account. This fidelity to the sign level is compensated by a special consideration of the user's pre-understanding at the retrieval side. Henrich's paradigm of information science is still a 'torso' with regard to its theoretical explanation, however, I believe it points in the right direction.

Finally I would like to refer to the 'ASK-theory' developed by N. J. Belkin, R. N. Oddy, and H. M. Brooks /33/. 'ASK' stands for 'anomolous states of knowledge', and means that "an information need arises from a recognized anomaly in the user's state of knowledge concerning some topic or situation and that, in general, the user is unable to specify precisely what is needed to resolve that anomaly" /34/.

According to this, the information retrieval process should be conceived in order to be able to actively interact with the requester's knowledge structures. IR systems should be able to initiate a dialogue with the user's large-scale intentions without asking him to specify first his information need.

Belkin stresses the importance of the user's 'conceptual state of knowledge' which is in interaction with his 'image of the world'. From a cognitive viewpoint, the authors suggest "that interactions of humans with one another, with the physical world and with themselves are always mediated by their states of knowledge about themselves and about that with which or with whom they interact. The IR situation is seeing as a 'recipient-controlled communication system, aimed at resolving the expressed information needs of humans, primarily via texts produced by other human beings." /35/.

Belkin's 'ASK Theory' can be considered, I think, against the background of hermeneutics.

The central role played by the recipient's knowledge structures in the 'ASK Theory' validates, I think, its explicit designation as a hermeneutical theory. Its emphasis on the knowledge structure of individual users should be expanded, in my opinion, by a consideration of intersubjectivity, and in particular of the user's reference community with which he shares a similar knowledge structure and from whom he expects to get some help in order to solve his specific anomalies.

Peter Ingwersen /36/ has recently related Belkin's cognitive model to B. C. Brookes' 'fundamental equation': $K(S) + \Delta I = K(S + \Delta S)$, where $K(S)$ is an existing knowledge structure affected by some increment of information ΔI, and $K(S + \Delta S)$ is the modified structure. Brookes refers this scheme to objectivized knowledge in the sense of Popper's 'world 3'. Ingwersen's critical adaptation of this model within the cognitive point of view consists of relating 'objective knowledge' to a human knowledge structure which it eventually modifies. This view transforms Brookes' statical equation into a dynamic process. The role of intersujectivity does not, to me, seem to have been taken into full consideration.

b) A hermeneutical theory of information science

The following is a rough outline of a hermeneutical theory of information science which takes the above mentioned approaches, as well as the argumentative discourses of hermeneutics discussed previously into account. Information science is delimited with regard to a general theory of information and communication. Delimitations are usually controversial. The field of 'scientific and technical information' has proved to be too restricted, particularly regarding societal information and all kinds of professional information which is not necessarily being produced by research centres and the like. I suggest we consider the structure of so-called 'specialized information' as something related to three basic parameters: professional communities, special fields of research or action and a communication process based mainly on represented knowledge.

1. Professional communities

Producers and users of specialized information are not isolated beings but belong to professional communities. These share a range of common theoretical and practical interests which build up their horizon of preunderstanding of action and/or research. This specific 'in-between' of a professional community belongs to the "'web' of human relationships" (H. Arendt) as mentioned above. Thus, problems or questions are interrelated in different ways within the whole of the existential structure as well as within the concrete 'personality system' or the individual user, i.e. his social, cultural, political, geographical, linguistical etc. system of references. One major aim of information science is the study of users and potential users, not just as isolated individuals, but as members of professional communities. Information science is particularly concerned with the study of how scientists go about obtaining information. The concept of 'specialized information' refers to the communication of knowledge contents to one (or to several) professional communities. Information in information science is a social category. By using the term 'professional' we are pointing to a generalization of the more limited term 'scientific community'. This, I think, is a necessary and useful generalization, as it takes into consideration the whole range of theoretical and practical issues which constitute the core of technological advanced societies in particular.

We are accustomed to regarding professionals as people with an in-depth knowledge of one specific field. The physicist W. Heisenberg has a somewhat different opinion. According to him, a professional ('Fachmann') is a person who knows some important mistakes in his/her field, and how to avoid them /37/. In other words, professionals are conscious of some major 'anomalies' in their fields and therefore have a questioning attitude, as they have learned to be cautious. Paradoxically this means that we should look upon professionals from the point of view of their ignorance.

A very Socratic viewpoint indeed.

Professional communities form a vocal point of the study of information science. We need to research the sociological theory of professional communities further (not only on a sociology of science). We must investigate the ways they gather and interpret information in order to solve common problems /38/.

Considering professional communities as an essential element of information science means to question:

- an isolating view of 'users' and their 'cognitive structures',
- a restricted view on 'scientific communities',
- a purely 'objective' view of represented information.

2. Special fields of research or action:

The special fields of research and action form a second element of information science. They build up the correlate of a professional community and are an expression of a changing common pre-understanding. K. Popper is right on the one hand when he says that we do not investigate subject matters or disciplines, but problems /39/. Problems are, on the other hand, related to a specific framework of theories, beliefs, traditions, interests and so on. In Popper's words, we would say that as there are no 'brute facts' there are no 'brute problems', but these are 'theory-impregnated'. Special fields of research and action are not necessarily identical with subject disciplines in universities. In information science the question of delimitation of a subject field plays a significant role. Our efforts in building up databases and expert systems is basically conditioned by the delimitation of a scope or field. Some of the empirical laws in our field, for instance the Bradford's law, refers to the regularities in identifying the core literature of a specific domain.

Our conception of subject fields has radically changed with regard for instance to the conception of classification schemes in the 19th century. We could call this change a kind of 'Copernican revolution': instead of considering knowledge as something invariable in the middle of the system, we have learned to be aware of the active role played by the interpreter and user of such schemes.

This is a dynamic and indeed relativating view of knowledge as something which is 'in-between' the members of a professional community or which is constituted by their professional horizon of expectations. The delimitation of a subject field also implies the use of specialized 'language games'. The study of the structure and use of such vocabularies including the use of infering devices in modern expert systems is indeed a second major concern of our field. Without the reference to such special fields it is also not possible to talk about specialized information.

3. Professional communication

This third element is mostly the main concern of information scientists, in particular with regard to the possibilities opened by modern communication technology. This technological view leaves aside, as Shannon and Weaver accurately remarked, the semantic and pragmatice levels of communication. Being concerned with specialized information in the sense of knowledge contents which are shared by professional communities, the semantic and pragmatic components of the communication process are at least as central to information science as the technical issues. Under a comprehensive view of human existence as it is developed by hermeneutics, communication is not reduced to the physical process of sending and receiving signals but as a specific human phenomenon it is a 'conditio sine qua non' of the evolution of knowledge. The freedom of thought is not to be considered idealistically as something independent of the ways of its communication, of talking and writing. Kant reminds us of this when he writes: "But, how much and how correct could we think, if we would not do it together with other people, to whom we can communicate our thoughts and they theirs!" /40/.
Communication means making knowledge publicly available. The concept of information expresses this potential availability, adding a new aspect to the concept of knowledge: information is knowledge seen from the point of view of its communicability.

> Here is the place where the concept of representation of knowledge, as used by modern cognitive science, becomes especially interesting for information science. In fact some information scientists, B. C. Brookes for instance, consider this point to be so important that they refer to the concept of information as 'objectivized knowledge' (in particular its written representation) and talk about 'objective information'. On the other hand, as P. Ingwersen remarks, 'objective information' should not be separated but dynamically integrated in the intersubjective process of interpretation. As information scientists we are not interested in building knowledge structures 'in themselves' in a 'per-Copernican' manner, but we concentrate on the possible interaction of represented knowledge with a community of users whose pre-understanding of a specific field is supposed to be partly objectivized /41/.

To sum up, the concept of information in information science denotes a social category, determined by three parameters: a professional community, i.e. the producers, interpreters and users of specialized information, a specific field of research or action to which (mostly) objectivized thought contents are supposed to refer primarily, and a communication process through which they are shared by the community. The following quotation from a recent article by Martha Williams resumes, in my opinion, the paradigm of information science, taking the three components I have discussed into consideration:

> "Information science is the quest to understand the nature of information, man's interaction with information, and the communication process. It is a developing discipline and, although it uses the tools and techniques or technologies of many other disciplines, it has its own subject matter (information) and its own problems (human communications)." /42/.

Information and meaning are very close concepts indeed, but they are not identical, as the concept of meaning is not usually related to that of communication. Information, on the other hand, should be potentially meaningful at least.

Fred I. Dretske argues in a recent study /43/ that the concept of information should not be confused with meaning but that it should be applied to all kinds of communication mechanisms.

From the point of view of information science I prefer to join Langefors in distinguishing between data and information. Nevertheless, as I have previously pointed out, the information concept, as we can see from its history, is a very rich one indeed. A broad application can be used to stress the common ground of different phenomena, as Dretske, who based his ideas on those of Shannon, suggested. However, unless we are monists, analogy does not mean identity, and as Y. Bar-Hillel remarked /44/, we must take care of the 'semantic traps'. Taking the three parameters I suggested into consideration, the concept of (specialized) information can be distinguished well enough, I think, from its other possible uses in information theory, neurobiology, computer science, sociology and so on.

c. Hermeneutics and Information Retrieval

With this background it is not difficult to make some references on the relevance of the hermeneutical paradigm not only regarding information science in general, but information retrieval in particular. I shall only give some hints which require more in-depth consideration. Databases (bibliographic, numeric, factual etc.) and other forms of knowledge representation such as expert systems, are objectivizations of specific pre-understanding. Their scope or conceptual horizon is supposed to be the correlate of the one shared by a professional community.

This must be clear before the information items can be inputed into the computer. Information systems are basically related to outside parameters. There is no 'absolute system' as there is no 'absolute information'. Classification schemes, indexing methods etc. delimit the possible horizon of interpretation which the bibliographic items fill in this case. The online dialogue can be considered as a special kind of hermeneutical process: on the one hand we have the fixed horizon of the system and on the other the open or 'existential' horizon of the enquirer. During the dialogue a 'fusion of horizons' takes place on different levels (descriptors, descriptive categories, contents of abstracts, classification etc.). The partial identity or 'fusion' between the horizon of the enquirer and the system's own is actively determined by the pre-understanding of the searcher and by his/her question/query formulation.

As far as the system can in some way correspond to the user's pre-understanding which is 'behind' his/her question, a partially 'positive' answer or 'fusion' takes place, within which the 'anomaly' expressed by the question can be 'solved'. In the case of bibliographic databases such a 'solution' usually means some indications (or references) to relevant source documents. Thus bibliographic databases only offer a very limited possibility of a 'fusion of horizons' as, for instance, expert systems do. Our capacity to build more intelligent information systems depends on our insight as to what pre-understanding of a professional community we want to objectivize. As D. R. Swanson remarks, the retrieval process can be compared to a 'trial-and-error' process in scientific research. He states, thus following Poppers' ideas, the following analogy: "Creative research does not begin with a 'topic' but with a problem - a researcher must be puzzled, curious, in a sense 'bothered' about something. Even this is not enough - some initial conjecture as to the nature of a possible solution to the problem at least must also be present. Theories are not synthesized from observations.

Quite the contrary; one cannot gather data or make an observation without first having a theory. (...) Analogously, we might look upon the process of information retrieval as a trial or a conjecture, guided by some idea of what one is seeking. The principle value of the process lies not so much in the direct use of the retrieved documents but rather in the indirect function which they serve of stimulating a reformulation of the request. A request (...) is a conjecture, which he tests by examining the retrieved documents.' /45/

The retrieval process can thus be primarily considered as a problem oriented process and not as a purely 'objective' or 'topic oriented' process. But it would be erroneous, I think, to divorce the horizon of the enquirer from the one he shares with his/her colleagues, and which is of course not to be considered as something definite or 'objective' in a pre-Copernican way. The existential 'ASK-situation' includes the theory or problem to be tested or solved as something interrelated with the pre-understanding of a professional community as well as with problems, goals and interests which are in different ways shared by society in general. The answers of the system are thus being 'matched'

against this complex background and not just against a query formulation or a 'discipline' dissociated from the whole 'existential structure'. The question of relevance in information retrieval must thus take these different levels as well as their interrelationships into account. T. Saracevic /46/ summarized this controversy some years ago. In his excellent 'Introduction to Modern Information Retrieval', G. Salton distinguishes between an 'objective' or system-oriented and a 'subjective' or user-oriented view or relevance /47/. Of course it would be wrong to identify the process of information retrieval with the conception of scientific research as a 'trial and error' process. Stephen P. Harter /48/ has recently emphasized the limits of this analogy, by pointing out, that the motivation and the subsequent treatment of the results obtained differ significantly in online searching and in scientific enquiry: "the raison d'etre of scientific research is its contribution to knowledge, to our theoretical understanding of ourselves and our universe. The purpose of online information retrieval is much less grandiose. (...) The results obtained do not ordinarily become part of a knowledge base or larger theory, as do the results of research." (p.111).

With regard to the two interpretations of relevance, the 'problem oriented' and the 'topical' one, we should avoid to divorce them, as we can no less divorce the individual enquirer from his professional community.

F. W. Lancaster /49/, agreeing in part with a terminological distinction made by D. A. Kemp, calls 'relevance' the relationship existing between a document and a request statement 'in the eyes of a particular individual or group of individuals', and 'pertinence' in the case that the 'judge' is the requester himself. This distinction is not only important as it explicitly considers 'objective' or 'subject related' relevance within a professional community, but also because it consequently regards both kinds of 'relevance' as being necessarily "subjective and equivocal" though "no less important in system evaluation." The reason why Lancaster can say that 'objective relevance' is 'subjective and equivocal' is, in my opinion, the (hermeneutical) consideration of the pre-understanding of an expert community as a dynamic and open parameter.

The matching of a request to a 'subject matter' is a relationship which is being done by one (or more) representatives of the (expert) community, 'subject matters' being nothing 'objective' or 'in themselves', but a 'relative' and often undefined 'horizon of pre-understanding' of such a community.

Finally we should also be aware that the scientific process of testing of hypotheses is one related to the 'truth' or 'falsity' of theories, whereas there is no such specific intention in online searching, the underlying purpose being to search and find information which is presumably relevant. The concept of 'error' as it is used in scientific methodology would, in this context, prove to be as misleading as the concept of 'truth'. As online searching is also not only reduced to scientific information but also concerns different kinds of (pragmatical) interests, the concept of 'relevance' with all possible levels of differentiation points to the complex nature of the information retrieval process, which can only be partially explained with the analogy of scientific enquiry.

By pointing out the necessity of the enquirer as a correlate of a request in order to talk about (problem-oriented) relevance, Swanson and Harper implicitly stress the intersubjective nature of information retrieval. In my opinion the hermeneutic paradigm offers more and more adequate possibilities to analyze the online process than the specific model of scientific enquiry. This is especially so because it takes the whole complexity of the 'existential ASK-situation' into account. The 'dialectic' of pre-understanding and understanding i.e. of the critical 'fusion' process between questions and answers, as a biased and critical process within which what is known as specialized information is always to be considered as tentative knowledge.

The present developments in the field of information retrieval heuretics should be reconsidered, I suggest, within the broader framework of information retrieval hermeneutics.

4. Conclusion

Databases, expert systems and so on are, as I have tried to point out, objectivizations of the specific pre-understanding of professional communities at least in as far as they are considered by the ill-defined field of information science. Professional knowledge is essentially tentative and non-authoritative and so also is the information we obtain from databases. They are a part of the communication process which is not only 'the essence of science'. (Garvey) /50/, but a characteristic of being human. In a newly published report on Artifical intelligence /51/ some of the lessons AI has learned are listed as follows:

1. AI is much more difficult than expected
2. Heuristic search is required to limit combinatorial explosion
3. The lack of contextual knowledge severely limits capability
4. Expectation is a human characteristic of intelligence
5. It is difficult to handle a broad domain (e.g. common sense).

These, are, in my opinion highly hermeneutical lessons.
M. Minsky /52/ sees the modern theories of intelligence to be moving away from traditional attempts in Psychology and Artifical Intelligence to try to represent knowledge as a collection of separate fragments. A central point in the new theories of intelligence is, according to Minsky, the concept of frame, which he defines as a 'data structure for representing a stereotyped situation' (p. 96). Minsky sees this frame concept in the tradition of Kuhns' paradigms: such a data-structure can be 'a collection of questions to be asked about a hypothetical situation.' (p. 109).
According to H. L. Dreyfus, /53/ Minskys' proposals are closely related to Husserl's phenomenology. 'The result' according to Dreyfus, 'is a step forward in AI techniques from a passive model of information processing to one which tries to take account of the context of the interactions between an expert and his world'. But, according to Dreyfus, AI comes to an impass when it tries to treat the broad background as an object. This is a metaphysical assumption, says Dreyfus, recalling Heideggers' criticisms of Western Metaphysics.

Intelligence must be situated, it cannot be separated from the rest of human life (p. 203). The assumption we could represent all "prejudices" is as illusory as the belief it could be possible to obtain unbiased knowledge.

To be intelligent means, for men and information systems, to be able to make conjectural inferences from a bulk of foreknowledge. This is an old truth which we find for instance in Aristotle. In his Analytics he writes: "All teaching and learning by way of reasoning proceeds from pre-existing knowledge" /54/.

If we are able to build up intelligent information systems it does not necessarily mean that they will become 'human' because being human means more than simply being intelligent.

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